Economic Analysis of Water Quality Based Effluent Limits for the City of Roundup Wastewater Treatment Facility

EPA has requested an economic analysis of water quality based effluent limits for nutrients for the City of Roundup wastewater treatment facility (WWTF), based on EPA Guidance and practice, and data availability. Abt Associates conducted a preliminary analysis consistent with EPA's Interim Economic Guidance for Water Quality Standards (U.S. EPA, 1995), and publicly available data. We present a summary of the analysis and our conclusions below. Since we limited our review to the economic analysis, we did not review the appropriateness of the water quality targets and resulting effluent limitations, or other potential bases for a variance.

1 Background

The City of Roundup WWTF is a 3-cell aerated lagoon system that includes two cells with static tube aerators, followed by a sedimentation cell, followed by effluent disinfection using ultraviolet (UV) light. The facility discharges to either the Musselshell River (Outfall 001) or to an impoundment/wetlands with no surface water discharge (Outfall 002). During the period of October 2009 through March 2013, nutrients in the facility's discharges were been as high as 44.3 milligrams per liter (mg/L) total nitrogen (TN) and 5.9 mg/L total phosphorus (TP) (Montana DEQ, 2013). Future average monthly limits for both outfalls would be 19.7 mg/L TN and 0.2 mg/L TP. Therefore, the facility could require upgrades to comply with the new limits.

2 Estimating Costs

We developed a preliminary estimate of incremental compliance costs to reach these permit limits using a Water Environment Research Foundation (WERF) report (WERF, 2011) that provides estimates of costs for hypothetical treatment trains providing various levels of nutrient removal. Specifically, Table 4-3 of WERF (2011) provides unit cost data that are based on flow (e.g., dollars per gallon per day capacity) for each of several levels of treatment. The WERF treatment levels are designed to meet the nutrient limits shown in Exhibit 2-1.

Exhibit 2-1: WERF (2011) Treatment Level Objectives

Level	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
1	No removal	No removal
2	8	1
3	4 to 8	0.1 to 0.3
4	3	0.1
5	<2	<0.02

As a lagoon system, the facility's existing treatment train is not equivalent to any of the WERF levels. Also, based on the monitoring data in the facility's permit statement of basis (Montana DEQ, 2013), the facility does not appear to be providing significant nutrient removal. Therefore,

for this analysis, we assume the existing equipment at the facility would need to be abandoned and replaced with a WERF-equivalent mechanical treatment train. The method used here to calculate incremental compliance costs does not include the costs of closing the existing lagoons. Therefore, the cost estimates might understate actual compliance costs. On the other hand, the facility already includes UV disinfection. The facility would likely retain this equipment, instead of installing a new sodium hypochlorite disinfection system, which is included in the WERF costs. It also is possible, although not certain, that some of the other existing equipment might be reused in the new treatment train (e.g., intake and effluent discharge equipment, existing aerators). Because they include the costs of equipment that already exists at the facility, the cost estimates overestimate actual compliance costs.

The facility's permit statement of basis (Montana DEQ, 2013) reports a design flow average of 0.320 million gallons per day (MGD). It reports an actual average flow of 0.085 MGD for the period October 2009 through March 2013. For this analysis, we use the design flow average of 0.320 MGD to estimate capital costs because the WERF capital estimates are scaled to an annual average design flow.[1] We use the actual average flow of 0.085 MGD to estimate operating costs because long-term ongoing operating requirements are most likely to reflect this flow.

To meet a future nutrient limit of 19.7 mg/L TN would require treatment corresponding to WERF level 2. To meet a future nutrient limit of 0.2 mg/L TP, however, would require treatment corresponding to WERF level 3 or 4. Because of the significant differences between these two requirements, the sections below consider two compliance scenarios: one where the facility must comply with a new TN limit only, and one where the facility must comply with new limits for both nutrients.

2.1 Estimating Costs for TN Compliance

For level 2 treatment, which would be required to comply with a new TN limit, WERF (2011) estimates capital costs of $12.7 million per MGD capacity and operations cost of $350 per million gallons treated. Applying these costs to the design and average flow for the City of Roundup results in a total capital cost of $4.06 million and an operating cost of approximately $10,900 per year (assuming year-round operation). We used the Engineering News Record (ENR) construction cost index (CCI) to escalate capital costs to current dollars by multiplying by 1.08.[2] Because WERF's operating costs are based on energy and chemical costs, we used the consumer price index (CPI) to escalate operating costs to current dollars by multiplying by 1.05.[3] This escalation results in a total incremental capital cost of $4.39 million and an incremental operations cost of approximately $11,400 per year in current year dollars.

---

[1] The WERF estimates also assume a peaking factor of 3. Data are not available on the peaking factor provided by the existing City of Roundup facilities.
[2] The average ENR CCI for 2014 was 9806 and the average ENR CCI for 2011 was 9070, resulting in an escalation factor of 9806 / 9070 = 1.08.
[3] The CPI for 2014 was 236.736 and the average CPI for 2011 was 224.939, resulting in an escalation factor of 236.736 / 224.939 = 1.05.

The WERF (2011) unit operating costs include energy and chemical costs only, not labor. Although incremental labor requirements can be minimized when automated controls are present, labor costs can be highly dependent on site-specific factors (U.S. EPA, 2008). For conventional activated sludge treatment as a whole, however, estimated labor costs can be as much as two-thirds of total annual operating costs (Young et al., 2012). Therefore, to account for potential incremental labor, we multiplied the incremental operating cost by three to $34,300 per year. Note that this incremental operating cost assumes year-round operation. Actual incremental operating costs would be lower if the nutrient criteria do not apply year-round and if elements of the upgraded treatment system could be shut down, bypassed, or placed on standby during the period when the criteria do not apply.

We annualized incremental capital costs over 20 years using an interest rate for revenue bonds of 2.5%, which is the current rate for the Montana Water Pollution Control State Revolving Fund (Montana DEQ, 2015). We added the incremental operating costs, including labor, to arrive at a standard total annualized cost estimate of $315,906 per year.

For purposes of sensitivity and uncertainty analysis, we also examined the impact of alternative assumptions used in Montana DEQ's previous economic analysis (Blend and Suplee, 2011). Montana DEQ's previous analysis examined various scenarios that included two different interest rates: 5% and 7%. The previous analysis also used a different method to estimate labor costs. Instead of applying a multiplier to annual operating costs, it estimated labor costs as a percentage of annualized capital costs. The scenarios examined used two different labor percentages: 15% and 48%.[4]

Based on the range of scenarios examined in Montana DEQ's previous analysis, we calculated results using two sets of alternative assumptions. Alternative 1 combines the lower interest rate of 5% with the lower labor estimate of 15% of annualized capital cost. Alternative 2 uses the higher interest rate of 7% and the higher labor estimate of 48% of annualized capital cost. Exhibit 2-2 compares our cost estimates with results using these alternative assumptions.

Exhibit 2-2: Comparison of Standard and Alternative Cost Estimates for TN Compliance

Scenario	Interest Rate	Labor	Total Annualized Cost ($/year)
Standard	2.5%	2/3 of total operating cost	$315,906
Alternative 1	5%	15% of annualized capital cost	$416,565
Alternative 2	7%	48% of annualized capital cost	$624,685

2.2 Estimating Costs for TP and TN Compliance

As discussed above, a future nutrient limit of 0.2 mg/L TP would require treatment

---

[4] Montana DEQ's previous analysis also examined different assumptions about the percent of flow treated by reverse osmosis. Because meeting future nutrient limits at this facility would not require reverse osmosis, those assumptions have no effect on the analysis here.

corresponding to WERF level 3 or 4. We assumed that level 4 treatment would be required to guarantee meeting the future TP limit, allowing for a safety factor. This level of treatment would also meet a future nutrient limit of 19.7 mg/L TN. For level 4 treatment, WERF (2011) estimates capital costs of $15.3 million per MGD capacity and operations cost of $880 per million gallons treated. Applying these costs to the design and average flow for the City of Roundup results in a total capital cost of $4.9 million and an operating cost of approximately $27,300 per year (assuming year-round operation). Applying the escalation factors discussed in Section 2.1 results in a total incremental capital cost of $5.29 million and an incremental operations cost of approximately $28,700 per year in current year dollars.

The WERF (2011) unit operating costs include energy and chemical costs only, not labor. Although incremental labor requirements can be minimized when automated controls are present, labor costs can be highly dependent on site-specific factors (U.S. EPA, 2008). For conventional activated sludge treatment as a whole, however, estimated labor costs can be as much as two-thirds of total annual operating costs (Young et al., 2012). Therefore, to account for potential incremental labor, we multiplied the incremental operating cost by three to $86,200 per year. Note that this incremental operating cost assumes year-round operation. Actual incremental operating costs would be lower if the nutrient criteria do not apply year-round and if elements of the upgraded treatment system could be shut down, bypassed, or placed on standby during the period when the criteria do not apply.

We annualized incremental capital costs over 20 years using an interest rate for revenue bonds of 2.5%, which is the current rate for the Montana Water Pollution Control State Revolving Fund. We added the incremental operating costs, including labor, to arrive at a standard total annualized cost estimate of $425,538 per year.

For purposes of sensitivity and uncertainty analysis, we also examined the impact of alternative assumptions used in Montana DEQ's previous economic analysis. As discussed above, based on the range of scenarios examined in Montana DEQ's previous analysis, we calculated results using two sets of alternative assumptions. Alternative 1 combines the lower interest rate of 5% with the lower labor estimate of 15% of annualized capital cost. Alternative 2 uses the higher interest rate of 7% and the higher labor estimate of 48% of annualized capital cost. Exhibit 2-3 compares our cost estimates with results using these alternative assumptions.

Exhibit 2-3: Comparison of Standard and Alternative Cost Estimates for TP and TN Compliance

Scenario	Interest Rate	Labor	Total Annualized Cost ($/year)
Standard	2.5%	2/3 of total operating cost	$425,538
Alternative 1	5%	15% of annualized capital cost	$516,883
Alternative 2	7%	48% of annualized capital cost	$767,739

3   Municipal Preliminary Screener

To demonstrate that the costs of pollution control would result in substantial and widespread economic and social impacts justifying a variance, the discharger must first demonstrate that it would face substantial financial impacts through a two-part test, including a municipal preliminary screener (MPS) and Secondary Test.

The first step in determining whether impacts will be substantial involves combining the estimated compliance costs with existing pollution control costs, and comparing the result (on a per-household cost basis) to median household income (MHI) to obtain an MPS value. Exhibit 3-1 shows the assumptions and data sources for the MPS calculation.

We assumed that the City of Roundup would pay for project costs using a Montana Water Pollution Control State Revolving Fund loan, and would not use any grant financing. We also assumed that households would pay for approximately 75% of project costs on the basis of the residential contribution to existing costs.[5]

Based on the assumptions and data shown in Exhibit 3-1, we calculate that the project could result in an MPS of 2.0% to 2.4%. Using the alternative interest rates, labor costs, and annual project costs shown in Exhibit 2-2 (and all other assumptions the same as Exhibit 3-1), the MPS would be 2.4% to 2.7% (Alternative 1) or 3.1% to 3.6% (Alternative 2). Based on EPA's 1995 Guidance, this indicates that the project may result in substantial economic impacts, and a Secondary Test is appropriate.

Exhibit 3-1: Municipal Preliminary Screener for City of Roundup

Variable	Estimate	Data Source
Capital costs (project costs plus land)	$4.39 million to $5.29 million	See Section 2
Annual O&M costs (electricity, salaries, testing, insurance, administration, supplies, and repairs)	$34,300 to $86,200	See Section 2
Interest rate for revenue bonds (for annualizing capital costs)	2.5%	Current interest rate for Montana Water Pollution Control State Revolving Fund (Montana DEQ, 2015)
Time period of financing (for annualizing capital costs)	20 years	
Annual project costs	$315,906 to $425,538	Annualized capital plus annual O&M
Number of households served	690	Sibley (2015)
Amount of annual existing costs paid by households	$200,304	Sibley (2015); residential revenue for August 2015 ($16,692) times 12.
Existing annual per-household costs	$290	Amount of existing costs paid by households divided by number of

[5] The City's Public Works Director (Sibley, 2015) indicated that household user charge revenues for August 2015 were approximately $16,692; assuming that is representative of a typical month, residential customers contribute approximately $200,305 out of total user charges of $266,750 (City of Roundup, 2015).

		households
Total annual cost of existing controls	$266,750	City of Roundup (2015)
Share of annual existing and project costs paid by households	75.1%	Amount of annual existing costs paid by households divided by total annual cost of existing controls[1]
Annual per-household pollution control project cost	$344 to $463	Household share of annual costs divided by number of households
Total annual cost of pollution control per household	$634 to $753	Household existing costs plus project costs
Median Household Income (2013$)	$31,111	U.S. Census Bureau (2013a)
Median Household Income (2014$)	$31,616	Adjusted based on Consumer Price Index (2014=236.74; 2013=232.96)
Municipal Preliminary Screener (MPS)	2.0% to 2.4%	Total annual cost of pollution control divided by median household income
Alternative 1 MPS[2]	2.4% to 2.7%	
Alternative 2 MPS[3]	3.1% to 3.6%	

O&M = operations and maintenance
1. We assume that households will pay for new project costs in the same proportion that they pay existing costs.
2. Alternative 1 assumes an annual project cost of $416,565 to $516,883 (Exhibit 2-2), which yields annual per-household project costs of $454 to $563 (total annual project costs times the share of costs to be borne by households, divided by the number of households) and total annual household costs of $744 to $853 (annual household project costs plus existing annual household costs).
3. Alternative 2 assumes an annual project cost of $624,685 to $767,739 (Exhibit 2-2), which yields annual per-household project costs of $680 to $836 (total annual project costs times the share of costs to be borne by households, divided by the number of households) and total annual household costs of $970 to $1,126 (annual household project costs plus existing annual household costs).

4   Secondary Test

If the MPS indicates that the economic effects of the pollution control project may be substantial (with a borderline impact being between 1% and 2% and a large impact being over 2%), the next step is to use the Secondary Test to evaluate the community's ability to obtain financing as well as general socioeconomic health. The Secondary Test is designed to build upon the characterization of the financial burden identified in the MPS. Indicators describe pre-compliance debt, socioeconomic, and financial management conditions in the community. For more information on the need for the Secondary Test, see the Appendix and U.S. EPA (1995).

Section 4.1 shows the Secondary Test for Roundup using U.S. EPA (1995) and Section 4.2 shows Montana's alternative Secondary Test (Montana DEQ, 2014), which eliminates debt and financial management indicators in favor of socioeconomic indicators. For more details on Montana's modified Secondary Test, see Exhibit 4-1 and Section 4.2.

Exhibit 4-1. Comparison of EPA 1995 Guidance and MT DEQ Guidance: Secondary Test of Substantial Impact, Public Entities

EPA Indicator	Interpretation	MT DEQ Indicator
Debt Indicators		
Bond Rating	Indicates the community's credit capacity.	None

Overall Net Debt as a Percent of Full Market Value of Taxable Property	Indicates the debt burden on residents and measures the ability of the community to issue additional debt.	None
Socioeconomic Indicators		
Unemployment Rate	Indicates the general economic health of the community.	Unemployment Rate
Median Household Income	Indicates overall wealth of the community.	Median Household Income Poverty rate[a] LMI percentage rate[b]
Financial Management Indicators		
Property Tax Revenue as a Percent of Full Market Value of Taxable Property	Indicates the funding capacity to support new expenditures, based on the wealth of the community.	(Property Tax + Fees + Revenues)/MHI/Population × 100[c]
Property Tax Collection Rate	Indicates the efficiency of the tax collection system and measures how well the local government is administered.	None
a. Evaluated as follows: strong: < 6%; midrange: 6% to 40%; and weak: >40%. b. Low to medium income (LMI) percentage rate, defined as the percent of population earning 200% of the poverty threshold or below. Evaluated as follows: strong: < 10%; midrange: 10% - 45%; weak: >45%. c. Evaluated as follows: strong: <1.5; midrange: 1.5 – 3.5; weak: >3.5.		

4.1 Secondary Test Based on EPA Guidance

To conduct the Secondary Test for Roundup using U.S. EPA (1995) Guidance, we used socioeconomic data from the U.S. Census Bureau (2013a; 2013b; 2013c), information about property values from Montana Department of Revenue (2015), and other financial data from Roundup's 2014 Annual Financial Report (AFR; City of Roundup, 2015).

Debt Indicators

Debt indicators include the bond rating, which provides a measure of the creditworthiness of the community, and the overall net debt as a percent of the full market value of taxable property, which is a measure of the debt burden on residents in the community and a measure of the ability of local government jurisdictions to issue additional debt.

We did not find a bond rating for the City of Roundup. As noted by U.S. EPA (1995), the absence of a bond rating does not indicate strong or weak financial health. Consistent with U.S. EPA (1995), we excluded this metric from the calculation of the Secondary Score.

The 2014 AFR reports that the City has no debt that is repaid by property taxes, and it does not show any overlapping debt (for entities such as school districts). However, the Roundup School District issued $9,837,000 in general obligation bonds for school construction and improvements in 2014 ($7,337,000 for the elementary school and $2,500,000 for the high school). Not all of this debt is borne by residents of Roundup, however; according to the bond issue, the elementary school district has a taxable market value of $355,263,712 while the high school district has a

taxable market value of $382,929,366. With a 2015 total taxable market value of $93,714,877 (Montana Department of Revenue, 2015), the City of Roundup represents approximately 26% of the elementary school district and 24% of the high school district. Applying those proportions to the school district debts yields overlapping debt for the City of $2,507,620.[6] As such, based on the overlapping debt for the School District, the overall net debt as a percent of full market value of taxable property is 2.7%.

However, this calculation does not fully reflect the amount of debt owed by the community, nor its potential ability to issue additional debt. The City also has $819,231 in long-term debt for sewer systems (City of Roundup, 2015), which are repaid with service fees. Although this debt is not repaid by property taxes, it impacts the community's ability to take on debt, which is the purpose of this indicator. Had this additional debt been financed via general obligation bonds rather than revenue bonds, for example, it would be repaid via property taxes and included in the debt used for this indicator. Including both types of debt would result in overall net debt as a percent of full market value of taxable property of 3.5% (although full market value of taxable property is not necessarily the appropriate comparison for both types of debt). As such, the City is mid-range on this metric based on U.S. EPA's 1995 Guidance.

Socioeconomic Indicators

Socioeconomic indicators include community-specific MHI (compared with the state level MHI) and the local unemployment rate (compared with the national rate). As shown in Exhibit 3-1, MHI for Roundup for the period 2009 to 2013 was $31,111. Data from the U.S. Census Bureau (2013b) indicates that MHI for Montana during the same period was $46,230.[7] Since the City's MHI is more than 10% below the state MHI, the City is weak on this indicator.

According to the United States Bureau of Labor Statistics, unemployment in Musselshell County was at 3.9% in June 2015, compared with a national unemployment rate of 5.3%. Since the local rate is more than 1% higher than the national rate, the City is strong on this indicator.

Financial Management Indicators

Financial management indicators include the property tax revenues as a percent of full market value of taxable property ("property tax burden") and property tax collection rate. Property tax burden indicates the funding capacity to support new expenditures, based on the wealth of the community, while the property tax collection rate provides an indicator of the efficiency of the tax collection system and a measure of how well the local government is administered.

According to the AFR (City of Roundup, 2015), property tax revenues for 2014 were $348,527.[8] As a share of the full market value of taxable property ($93,714,877), property tax revenues are 0.4%. Since this is below 2%, the City is strong on the property tax burden metric. However, as

---

[6] [26% x $7,337,000] + [24% x $2,500,000]
[7] Income is not updated to current dollar years for the Secondary Test.
[8] Including $192,350 in the general fund and $156,177 in non-major special funds.

with the debt indicator discussed above, debt for wastewater projects may not necessarily be repaid by property taxes (e.g. it is likely repaid by service fees), and this metric may not fully reflect the community's ability to support new expenditures.

The AFR provides information for the property tax collection rate for the fiscal year 2014. U.S. EPA (1995) defines the property tax collection rate as the ratio of the actual amount collected from property taxes to the amount levied. However, the amount levied for the City of Roundup is not available in the AFR; as such, we used the ratio of the actual amount collected to the final amount budgeted.[9] For fiscal year 2014, the final amount budgeted for the general fund and special funds was $347,392, while the actual amount collected for those funds was $348,527, for a collection rate of 100.3%. As such, the City is strong on this indicator.

Secondary Test Data and Results
Exhibit 4-2 shows available data for the Secondary Test and Exhibit 4-3 provides the Secondary Score.

Exhibit 4-2: Secondary Test Data Based on EPA Guidance

Variable	Value	Data Source
Number of Households	690	see Exhibit 3-1
Median Household Income (2013$)	$31,111	see Exhibit 3-1
State Median Household Income	$46,230	U.S. Census Bureau (2013b)
Community unemployment rate	3.9%	June 2015 unemployment rate for Musselshell County from Bureau of Labor Statistics
National unemployment rate	5.3%	June 2015 unemployment rate for United States from Bureau of Labor Statistics
Market value of taxable property	$93,714,877	2015 Total Market Value from the Montana Department of Revenue (2015)
Property tax collection rate	100.3%	Actual property tax collection for general and non-major funds ($348,527) divided by final budgeted amount for those funds ($347,392) from City of Roundup (2015)[1]
Direct net debt	$819,231	Revenue bond balance from City of Roundup (2015)
Overlapping debt	$2,507,620	Amount of General Obligation Bonds issued for school building construction by the Roundup School District in 2014 times the share of the total market value of taxable property that is in the City of Roundup
Property tax revenues	$348,527	Actual property tax collection for general and non-major funds from City of Roundup (2015)
1. The 1995 Guidance defines the property tax collection rate as the ratio of the actual amount collected from property taxes to the amount levied. However, the amount levied for the City of Roundup is not available; as such, we used the ratio of the actual amount collected to the final amount budgeted.		

Exhibit 4-3: Secondary Score Based on EPA Guidance

---

[9] City of Roundup (2015) provides both the original budgeted amount and the final budgeted amount.

Indicator	Result	Score
Bond Rating	Not Available	n/a
Overall Net Debt as Percent of Full Market Value of Taxable Property	3.5%	2
Unemployment	3.9% [compared to 5.3% nationally]	3
Median Household Income[1]	$31,111 [compared to $46,230 statewide]	1
Property Tax Revenues as a Percent of Full Market Value of Taxable Property	0.4%	3
Property Tax Collection Rate	100.3%	3
Average of Financial Management Indicators[2]	$(3 + 3) \div 2$	3
Secondary Score[3]		*2.3*

Source: See Exhibit 4-2.
1. Not updated for the Secondary Test.
2. If one of the debt or socioeconomic indicators is not available (in this case, the bond rating), the two financial management indicators (property tax revenues as a percent of full market value of taxable property and property tax collection rate) are averaged and this averaged value is used as a single indicator with the remaining indicators.
3. Average of scores for the following indicators: Overall net debt as a percent of full market value of taxable property, unemployment, median household income, and average of financial management indicators.

4.2 Secondary Test Based on Montana Alternative

In comparison with EPA's 1995 Guidance Secondary Test, the Montana DEQ (see Montana DEQ, 2014) has modified the Secondary Test such that much of the financial and debt information is not considered (eliminating both debt indicators in favor of socioeconomic indicators, and eliminating or altering both financial management indicators), but more information on household income is provided.[10] Exhibit 4-4 shows the metrics and interpretation using Montana's alternative approach. This section calculates the Secondary Score based on Montana's alternative approach.

Exhibit 4-4. Secondary Test Based on Montana DEQ Guidance

Indicator	Weak (Score of 1)	Mid-Range (Score of 2)	Strong (Score of 3)
Poverty Rate	More than 40%	6 to 40%	Less than 6%
Low to Medium Income Percentage (LMI)	More than 45%	10 to 45%	Less than 10%
Unemployment	More than 1% above state average	State average	More than 1% below state average
Median Household Income	More than 10% below state median	State median	More than 10% above State median

---

[10] This approach assumes that "the ability of a community to finance a project may be dependent upon existing household financial conditions within that community" (Montana DEQ, 2014).

Property Tax, fees and revenues[1] divided by MHI and indexed by population	More than 3.5	1.5 to 3.0	Less than 1.5
1. The "property tax, fees, and revenues" metric includes the following items from the Statement of Activities: charges for services, fees, and forfeitures for governmental activities; charges for services, fines, and forfeitures for business-type activities; and property taxes for governmental activities.			

For the unemployment rate and MHI, we used the same data sources as cited in Exhibit 4-2. Because the local unemployment rate is within 1% of the state unemployment rate,[11] the City is mid-range on this indicator. As with the results using EPA's Guidance, the City is weak on the MHI indicator since the local MHI is more than 10% below the state-level MHI. For the poverty rate, data from U.S. Census Bureau (2013b) indicates that the 13.2% of all families in Roundup are below the poverty threshold, which is in the mid-range according to Montana's Guidance. Based on data from U.S. Census Bureau (2013c), the City is also mid-range on the "Low to Medium Income Percentage" (LMI) indicator, with 44.3% of families earning less than 200% of the poverty threshold.

Montana's final Secondary Test indicator is the "Revenues, Taxes, and Fees Burden Index," which is calculated as:

This metric is intended to reflect the government revenue burdens of the local population, and includes the following three revenue streams from the Statement of Activities in the 2014 AFR (City of Roundup, 2015): charges for services, fines, and forfeitures for governmental activities ($46,176); charges for services, fines, and forfeitures for business-type activities ($758,192); and property tax revenues for governmental activities ($402,809). These revenues sum to $1,207,177. Dividing by MHI ($31,111 in 2014$; see Exhibit 3-1) and indexing by population (1,951 based on U.S. Census Bureau, 2013a) yields a metric value of 2.0, which is mid-range.

Exhibit 4-5 shows the Secondary Test using Montana DEQ Guidance. The City has a Secondary Test score of 1.8 using this alternative approach (compared with 2.3 using EPA's Guidance).

Exhibit 4-5: Secondary Score Metrics Based on Montana DEQ Guidance

Indicator	Result	Score	Data Source
Poverty Rate	13.2%	2	U.S. Census Bureau (2013b)

---

[11] Note that Montana's alternate Secondary Test compares the local unemployment rate to the state, whereas EPA's Guidance compares it to the national rate.

Low to Medium Income Percentage (LMI)	44.3%	2	U.S. Census Bureau (2013c)
Unemployment	3.90% [compared with 3.90% for the state]	2	June 2015 unemployment rate for Musselshell County and Montana from Bureau of Labor Statistics
Median Household Income	$31,111 [compared with $46,230 for the state]	1	U.S. Census Bureau (2013b)
Property Tax, fees and revenues[1] divided by MHI and indexed by population	2.0	2	Tax, fee, and revenue data from City of Roundup (2015)
Secondary Score[2]		*1.8*	

1. The "property tax, fees, and revenues" metric includes the following items from the Statement of Activities: charges for services, fees, and forfeitures for governmental activities; charges for services, fines, and forfeitures for business-type activities; and property taxes for governmental activities.
2. Average of scores for the five indicators.

5 Substantial Impact Analysis

Given an MPS of 2.0% to 2.4% (with a range of 2.4% to 3.6% using alternative scenarios; see Section 3), and a Secondary Score of 2.3 or 1.8 (using either EPA's 1995 Guidance or Montana's modified Guidance, respectively; see Section 4), the Substantial Impacts Matrix (Exhibit 5-1) indicates that impacts from the project are likely to be substantial. Further analysis would be needed to determine whether impacts would also be widespread.

Exhibit 5-1. Substantial Impacts Matrix

Secondary Score	Municipal Preliminary Screener		
	Less than 1%	1% to 2%	Greater than 2%
Less than 1.5	?	X	X
1.5 to 2.5	✓	?	X
Greater than 2.5	✓	✓	?

Source: U.S. EPA (1995)
X = impact is likely to be substantial
? = impact is borderline
✓ = impact is not likely to be substantial

6 References

Blend, Jeff and Michael Suplee. 2011. Demonstration of Substantial and Widespread Economic Impacts to Montana That Would Result if Base Numeric Nutrient Standards had to be Met in 2011/2012. Helena, MT: Montana Dept. of Environmental Quality.

City of Roundup. 2015. Annual Financial Report. Provided by Montana Department of Administration, Local Government Services Bureau.

Montana Department of Environmental Quality (Montana DEQ). 2015. Water Pollution Control State Revolving Fund Intended Use Plan and Project Priority List: State Fiscal Year 2016.

Montana Department of Environmental Quality (Montana DEQ), Permitting and Compliance Division. 2013. Montana Pollutant Discharge Elimination System (MPDES) Statement of Basis for Vaughn Cascade County Sewer District (Permit # MT0021440).

Montana Department of Revenue. 2015. 2015 Certified Taxable Values Report for each county in Montana. Available at: https://revenue.mt.gov/valuation-process#Certification-of-Values-879 (accessed 11/6/2015).

Sibley, Lon. 2015. Personal Communication, Public Works Director for City of Roundup, September 29, 2015.

United States Census Bureau. 2013a. American Community Survey (ACS) Demographic and Housing Estimates. Table DP05. 2009-2013 5-year Estimates for All Places in Montana and for Montana.

United States Census Bureau. 2013b. American Community Survey (ACS) Selected Economic Characteristics Table DP03. 2009-2013 5-year Estimates for All Places in Montana and for Montana.

United States Census Bureau. 2013c. American Community Survey (ACS) Table C17002: Ratio of Income to Poverty Level in the Past 12 Months. 2009-2013 5-year Estimates for All Places in Montana and for Montana.

United States Environmental Protection Agency (U.S. EPA). 2008. Municipal Nutrient Removal Technologies Reference Document. EPA 832-R-08-006. September.

United States Environmental Protection Agency (U.S. EPA). 1995. Interim Economic Guidance for Water Quality Standards: Workbook. EPA-823-B-95-002.

Water Environment Research Foundation (WERF). 2011. Striking the Balance Between Nutrient Removal in Wastewater Treatment and Sustainability. Final Report. NUTR1R06n.

Young, T., M. Muftugil, S. Smoot, and J. Peeters. 2012. "MBR vs. CAS: capital and operating cost evaluation." Water Practice & Technology 7:4.

7 Appendix: Description of the Economic Guidance for Water Quality Standards

In order to demonstrate that there would be substantial and widespread economic and social impacts justifying a variance, the discharger must demonstrate that it would face substantial financial impacts, and that the affected community would have significant adverse impacts as a result (i.e., widespread impacts). EPA's 1995 Guidance (U.S. EPA, 1995) outlines the specific

steps that the discharger must follow to make these demonstrations. This appendix provides a brief overview of the Guidance as applicable to an entity in the public sector. For a more detailed description of the analysis, see U.S. EPA (1995).

First, to determine whether the pollution control project would entail a substantial impact to an entity in the public sector, there is a two part test. The first part of the test, called the Municipal Preliminary Screener (MPS), is a screening-level ratio designed to trigger additional tests or screen out the possibility of substantial impacts. Since municipalities will pass costs on to households and businesses, this screening is based on how household pollution control costs compare to household income. Generally, if the MPS is less than 1% (i.e., annual household pollution control costs would be less than 1% of median household income), there will not be a substantial economic impact. If the MPS is higher than 1%, then the impacts may be substantial and the discharger proceeds to the second part of the test.

The second part of the test involves calculating multiple indicators (e.g., bond rating, debt ratio, and tax collection ratio) designed to characterize the financial health and socioeconomic status of the community that will bear the costs of the pollution control. This is the Secondary Test. **Exhibit 5-1** shows the indicators used in the Secondary Test and the scores associated with them.[12] The overall Secondary Score is the average of the indicators used.

Exhibit 5-1. Secondary Test Indicators in EPA's Guidance

Indicator	Secondary Indicator Scores		
	Weak (Score of 1)	Mid-Range (Score of 2)	Strong (Score of 3)
Bond Rating	Below BBB (S&P) Below Baa (Moody's)	BBB (S&P) Baa (Moody's)	Above BBB (S&P) Above Baa (Moody's)
Overall Net Debt as Percent of Full Market Value of Taxable Property	Above 5%	2% - 5%	Below 2%
Overall Net Debt Per Capita	Greater than $3,000	$1,000 - $3,000	Less than $1,000
Unemployment	More than 1% above national average	National average	More than 1% below national average
Median Household Income	More than 10% below state median	State median	More than 10% above state median
Property Tax Revenues as a Percent of Full Market Value of Taxable Property	Above 4%	2% - 4%	Below 2%
Property Tax Collection Rate	< 94%	94% - 98%	> 98%

---

[12] In some cases, if data for a particular indicator is not available, the Guidance directs users to alternative indicators. See U.S. EPA (1995) for more details.

The MPS and Secondary Test results are evaluated jointly, using the Substantial Impacts Matrix, as shown in **Exhibit 5-2**.

Exhibit 5-2. Substantial Impacts Matrix

Secondary Score	Municipal Preliminary Screener		
	Less than 1%	1% to 2%	Greater than 2%
Less than 1.5	?	X	X
1.5 to 2.5	✓	?	X
Greater than 2.5	✓	✓	?

Source: U.S. EPA (1995)
X = impact is likely to be substantial
? = impact is borderline
✓ = impact is not likely to be substantial

If the evaluation indicates that the pollution control project will place substantial economic burdens on the discharger, the next step is to determine whether the impacts will also be widespread in the surrounding community. This step involves estimating socioeconomic changes due to pollution control costs, such as loss of employment, changes in property values, and higher taxes. In this step, the analysis should consider the direct and indirect effects of control costs. Also, expenditures on pollution control costs are not likely to vanish from the community. These expenditures become business revenues and household incomes that can offset adverse financial impacts experienced by the affected entities.